

What is claimed is:

1. A body-sound sensor comprising:
a housing (110);
a skin-contact diaphragm (120) attached across a recess or opening in the housing,
a piezoelectric device (170) having a first portion mounted in a fixed relationship to the housing and a second portion displacementally coupled to the diaphragm; and
a solid-state amplifier (190) having a signal input coupled to the device, wherein the device and amplifier together have a frequency response at least including a range from below approximately 1 hertz to above approximately 250 hertz.

2. The sensor according to claim 1, wherein the housing and the skin-contact diaphragm are stainless steel.

3. The sensor according to claim 2, wherein the diaphragm has a skin-contact surface with a skin-contact dimension of between approximately 0.4 inch and 0.6 inch.

4. The sensor according to claim 1, wherein the diaphragm has a skin-contact surface with a skin-contact dimension of between approximately 0.4 inch and 0.6 inch.

5. The sensor according to claim 1, wherein the solid-state amplifier (190) includes a MOSFET input stage having an input resistance high enough to provide a frequency response that extends below approximately 0.1 hertz.

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6. The sensor according to claim 1, wherein the solid-state amplifier (190) comprises:
- an input/output signal wire;
 - a ground signal path;
 - a voltage divider, the voltage divider coupled between the input/output signal wire and the ground;
 - a drain resistor coupled to the ground;
 - a gate resistor coupled to the ground;
 - a MOSFET input transistor having a gate coupled to receive a signal from the piezoelectric device (170), a source coupled to an intermediate point of the voltage divider, and a drain, wherein the drain resistor is coupled between the drain and the ground, and the gate resistor is coupled between the gate and the ground;
 - and
 - a bipolar output transistor having a collector coupled to the input/output signal wire, an emitter coupled to the ground, and a base coupled to the drain of the input transistor.

7. The sensor according to claim 6, wherein the piezoelectric device (170) includes a piezoelectric double-plate ceramic element, wherein two thin plates are bonded together so they amplify their piezoelectric actions.

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8. The sensor according to claim 1, wherein the piezoelectric device (170) includes a piezoelectric double-plate ceramic element, wherein two thin plates are bonded together so they amplify their piezoelectric actions.

9. The sensor according to claim 1, further comprising a constant-current source coupled to the amplifier.

10. The sensor according to claim 6, further comprising a constant-current source coupled to input/output wire of the amplifier.

11. A piezoelectric acoustical pressure sensor including:
a stainless-steel housing, the housing having a skin-contact diaphragm, the diaphragm having a skin-contact surface with a skin-contact dimension of between approximately 0.3 inch and 0.7 inch;
a piezoelectric device displacementally coupled to the diaphragm;
a solid-state amplifier having a signal input coupled to the device, the device and amplifier together having a frequency response of approximately 0.1 hertz to at least approximately 250 hertz.

12. The sensor according to claim 11, wherein the solid-state amplifier (190) comprises:
an input/output signal wire;
a ground signal path;
a voltage divider, the voltage divider coupled between the input/output signal wire and the ground;
a drain resistor coupled to the ground;
a gate resistor coupled to the ground;
a MOSFET input transistor having a gate coupled to receive a signal from the piezoelectric device (170), a source coupled to an intermediate point of the voltage divider, and a drain, wherein the drain resistor is coupled between the drain and the ground, and the gate resistor is coupled between the gate and the ground;
and
a bipolar output transistor having a collector coupled to the input/output signal wire, an emitter coupled to the ground, and a base coupled to the drain of the input transistor.

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Part 94

13. A method for sensing body sounds comprising the steps of:
displacing a skin-contact diaphragm using changing pressure at a skin
surface to create a diaphragm displacement;
converting the diaphragm displacement into a piezoelectric displacement;
generating an electrical signal representative of the piezoelectric
displacement;
and

amplifying the electrical signal, wherein the steps of displacing, converting,
and amplifying together have a frequency response at least including a range from
below approximately 1 hertz to above approximately 250 hertz.

14. The method according to claim 13, wherein the diaphragm is stainless
steel.

15. The method according to claim 14, wherein the diaphragm has a skin-
contact surface with a skin-contact dimension of between approximately 0.4 inch
and 0.6 inch, and is approximately 0.006 inch thick.

16. The method according to claim 13, wherein the diaphragm has a skin-
contact surface with a skin-contact dimension of between approximately 0.4 inch
and 0.6 inch.

17. The method according to claim 13, wherein the step of amplifying includes
using a MOSFET input stage having an input resistance high enough to provide a
frequency response that extends below approximately 0.1 hertz.

18. The method according to claim 13, wherein the step of amplifying
comprises the steps of:
providing a constant-current source and a ground signal path;

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coupling a voltage divider between the constant-current source and the ground;

coupling the signal from the piezoelectric displacement to a gate of a MOSFET input transistor, the MOSFET transistor having a source coupled to an intermediate point of the voltage divider, and a drain, wherein a drain resistor is coupled between the drain and the ground, and a gate resistor is coupled between the gate and the ground; and

coupling a signal from the MOSFET transistor to a base of a bipolar output transistor having a collector coupled to the constant-current source, and an emitter coupled to the ground.

19. The method according to claim 13, wherein the piezoelectric displacement is to a piezoelectric double-plate ceramic element, wherein two thin plates are bonded together so they amplify their piezoelectric actions.

20. The method according to claim 15, wherein the piezoelectric displacement is to a piezoelectric double-plate ceramic element, wherein two thin plates are bonded together so they amplify their piezoelectric actions.

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